National Wadeable Streams Assessment

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Recent Critiques of Water Monitoring Programs

- General Accounting Office, 2000
  - EPA and States cannot make statistically valid inferences about water quality and lack data to support management decisions

- National Research Council, 2001
  - A uniform, consistent approach to ambient monitoring and data collection is necessary to support core water quality programs

- National Academy of Public Administration, 2002
  - Improved water quality monitoring information is necessary to help states make more effective use of limited resources

- Heinz Center Report, 2002
  - There is inadequate data for national reporting on fresh water, coastal and ocean water quality indicators.

- Draft Report on the Environment, 2003
  - No current way to develop a national picture of water quality

Current State of Water Quality Monitoring

- Current monitoring and assessment approaches are limited --
  - Most focus on targeted monitoring
  - Assess limited percentage state waters and water body types (19% rivers and streams, 43% lakes, 36% estuaries, 4% wetlands)
  - Generally not comparable across states
  - Difficulty demonstrating effectiveness of program actions and allocation of resources

Vision for Future

- We have adequate monitoring data to assess the condition of waters of the U.S. and make sound management decisions
    - By maximizing partnerships, and
    - Using best combination of monitoring tools to answer key questions at national, regional, state and local scales
- We can effectively target water quality actions to maximize benefits and save costs.

Strategy for Achieving the Vision

- Strengthen state programs
  - Invest in state/tribal programs through grants and technical support
- Use multiple monitoring tools
  - Seek and transfer tools to support full range of decisions for all water body types
- Expand accessibility and use of data
  - Encourage comparability of methods and reporting
  - Improve communication of water quality results
- Promote Partnerships
  - Collaborate to maximize use of monitoring resources

Strengthen State Programs

- $100M shortfall for state monitoring
- Comprehensive state strategies by FY05
- Seek and transfer examples of streamlining and efficiency
  - So. California – partnerships to redesign monitoring to address broader range of management needs
  - Indiana, Florida – Watershed Monitoring Program uses combination of probability and targeted monitoring
  - National Coastal Assessment – collaboration among EPA and coastal states to assess condition of 100% of coastline with random sample

# Promote the Use of Multiple Monitoring Tools

- Predictive tools

- Probability-based (randomized) designs

- Targeted monitoring designs

- Innovative approaches

...to support full range of decision objectives for all water body types at multiple scales.
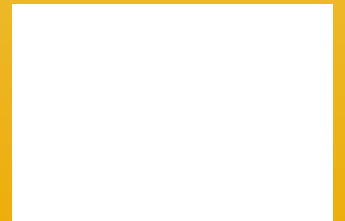
National Streams Assessment Basic Framework

- Randomly generated sampling locations
- Standard Operating Procedures (SOPs) adapted from EMAP-Western Streams
  - Benthic macroinvertebrate
  - Physical habitat
  - Ambient chemistry
- Strict QA/QC
- Sampling in 2004 to compliment Western data
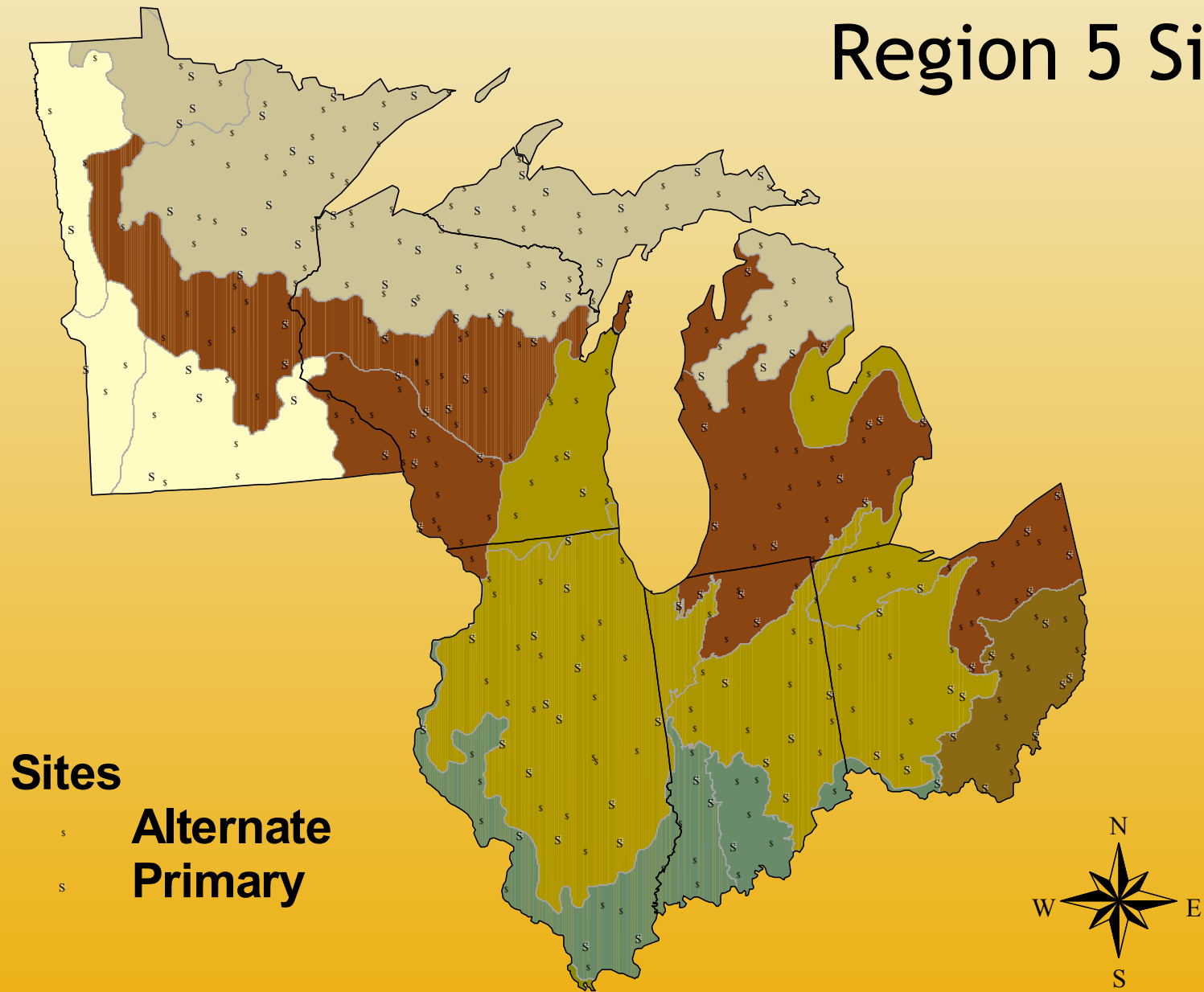- Report in December, 2005
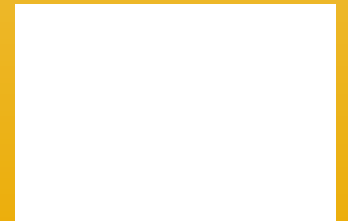
Site Selection

- RF3/NHD 1:100,000 scale network
- Stream orders 1-4/5
- Probability design with Level II Ecoregion, EPA Region, and 4-digit HUC reporting capability
- 500 primary sites distributed over 10 ecoregions (complement 600 sites surveyed by Western states)

Wadeable Stream Sites: Regions 1-7

Sites

s **Alternate**

s **Primary**

800　　　　0　　　　800　　　　1600 **Miles**

N
W E
S

Region 5 Sites
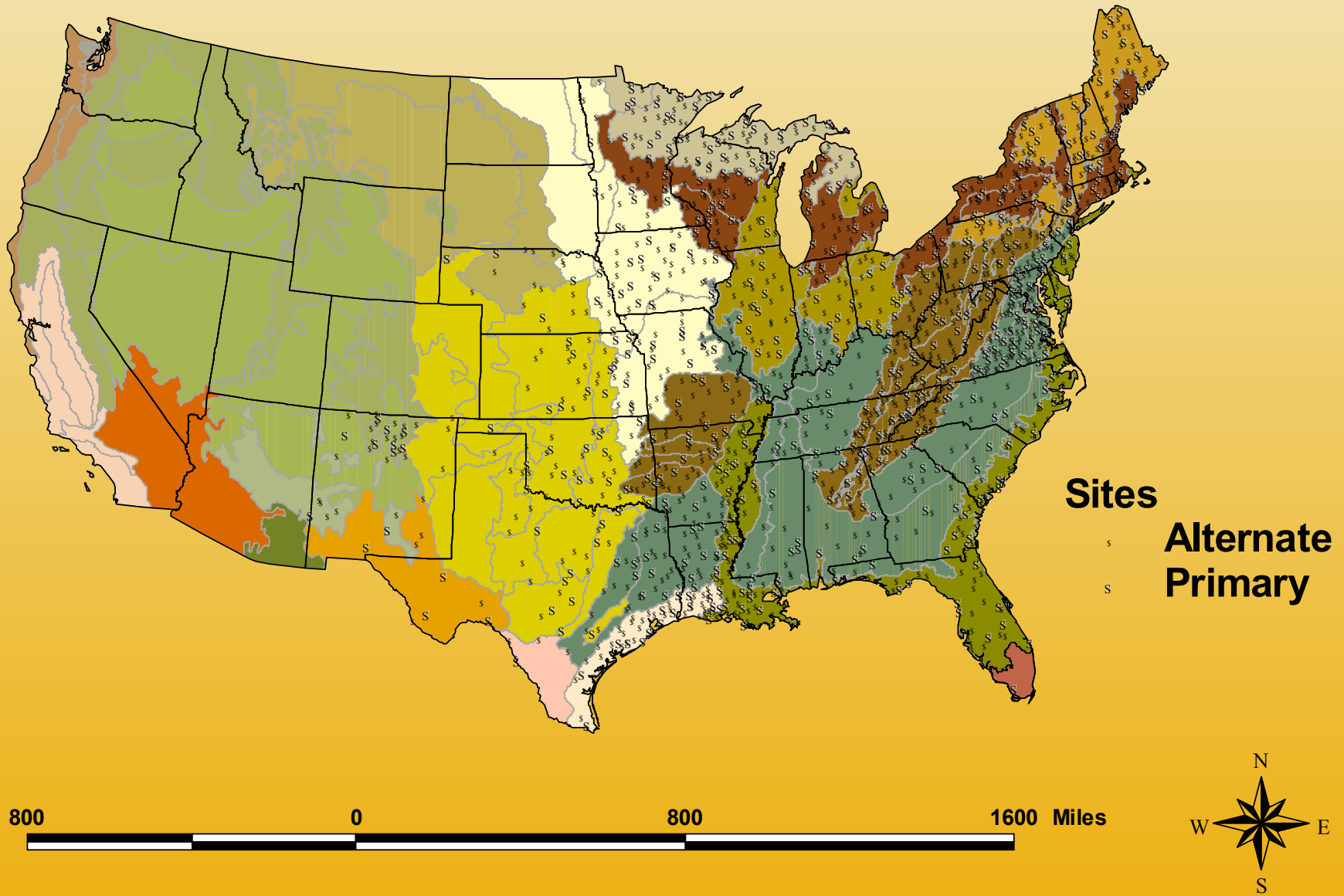
Sites
  s   Alternate
  s   Primary

Site Evaluation

- Standardized forms and protocols
- Office Evaluation
  - Map/Aerial Photo Information
  - Phone/letter Contact
- Field Evaluation
  - Prior to field sampling if office evaluation inconclusive
  - Final determination of target/non-target status occurs during scheduled field sampling visit

Standard Field Documents

- QAPP
- SOPs
- Site verification packet
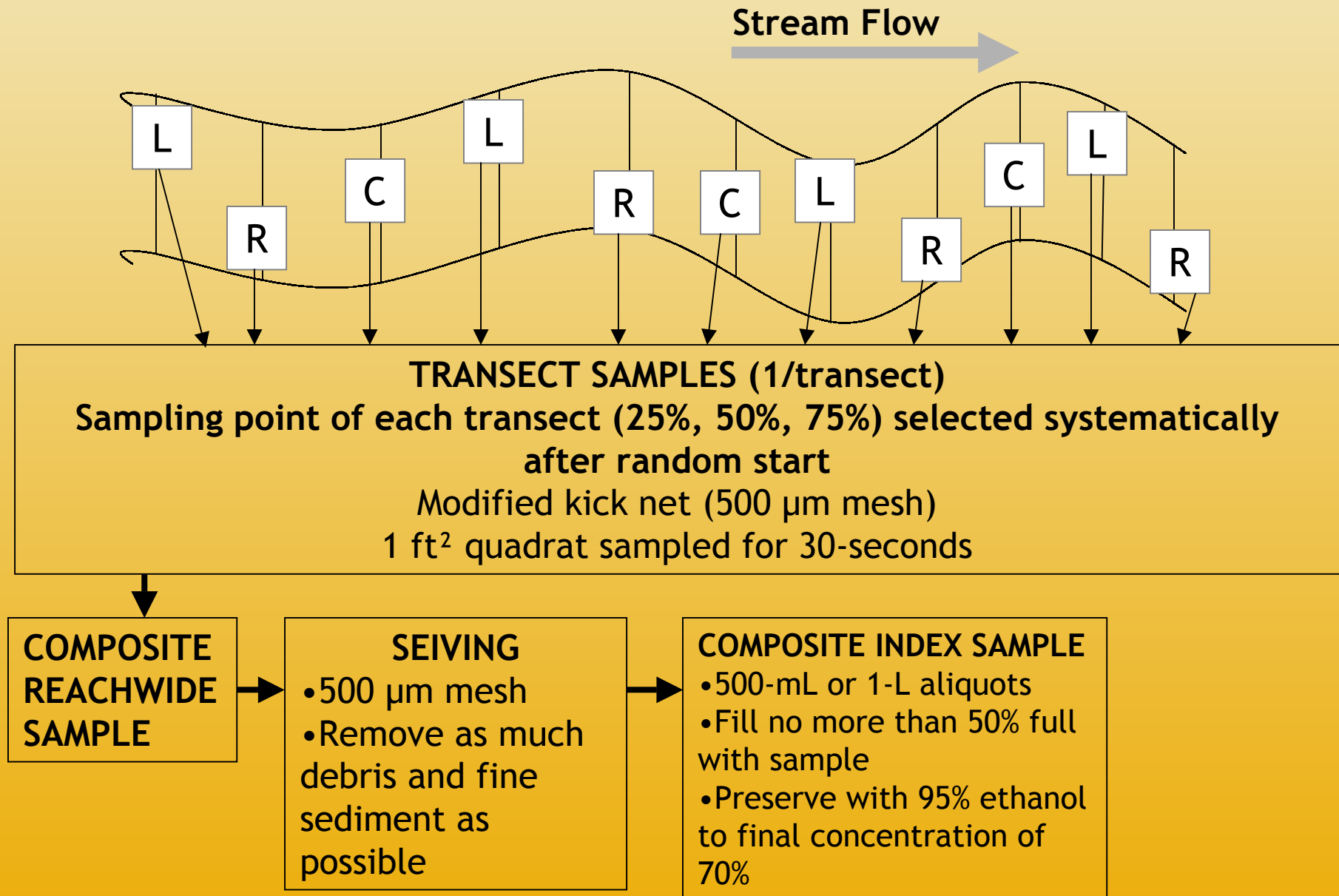- Field packets
- Chain of Custody

Key Components

- Benthic Macroinvertebrate collections
- Physical Habitat assessment
- *In situ* Chemical measurements
- Water samples for selected chemical parameters
- Comprehensive Quality Assurance Program
- Standardized data management system
- Analysis plan for assessment and reports

Benthic Macroinvertebrates

- Reach-wide sampling (Length = 40x width)
- D-Net, 500µm mesh
- 30-second sample per 1 ft^2
- Left (25%)/Center (50%)/Right (75%) alternating sampling scheme
- 95% ethanol preservative

Benthic Macroinvertebrates

Stream Flow →

L R C L R C L L R C L R

TRANSECT SAMPLES (1/transect)
Sampling point of each transect (25%, 50%, 75%) selected systematically after random start
Modified kick net (500 µm mesh)
1 ft² quadrat sampled for 30-seconds

COMPOSITE REACHWIDE SAMPLE →

SEIVING
•500 µm mesh
•Remove as much debris and fine sediment as possible

→

COMPOSITE INDEX SAMPLE
•500-mL or 1-L aliquots
•Fill no more than 50% full with sample
•Preserve with 95% ethanol to final concentration of 70%

Physical Habitat Assessment

- Five components of quantitative survey
  - Thalweg profile
  - Woody debris tally
  - Channel and Riparian characterization
  - Assessment of channel constraint, debris torrents, and major floods
  - Discharge
- Visual-based assessment
  - 14 metrics of RBPs

Quality Assurance Program

- Detailed Quality Control procedures
- Field and laboratory audits
- Chain-of-Custody procedures
- Qualified laboratory for chemical analyses and biological sample sorting
- Trained taxonomists using the most up-to-date and widely accepted technical literature
- Rigorous data entry QC

Data Management

- Generate raw data files
  - Input field data sheets
  - Link lab analytical data, including QA/QC
  - Error checks
- Perform validation and verification
- Transfer to states, grantees and STORET

Methods Comparability Analysis

- Use multiple field protocols at sites
- Replicate sampling at some sites
- Strict QA/QC of all aspects of protocol
- Analyze key endpoints
- Calculate precision (RPD), similarity, and sensitivity (DE)
- Incorporate into report

Data Analysis and Interpretation Options

- Descriptive statistics on condition at ecoregion II, EPA region, national scale
  - Basic analysis of data sets designed to describe populations
  - Describe central tendency (mean, median) and variation
- Interpretation of data in context of good, fair, poor
  - Define expected/reference condition to use as threshold or benchmark for evaluation
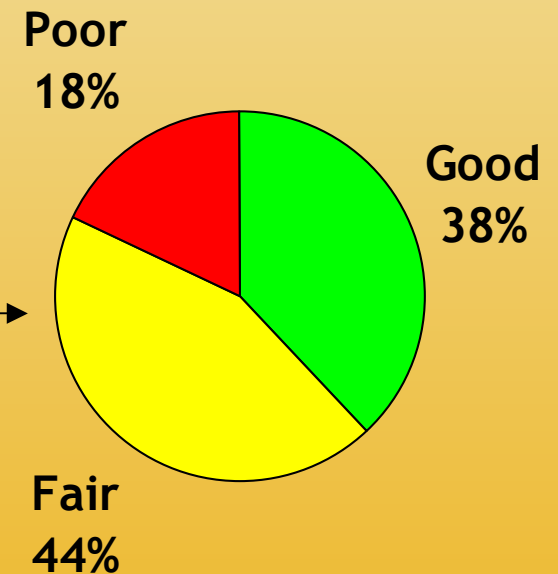 - Examine impact of methodological differences

Data Analysis and Interpretation
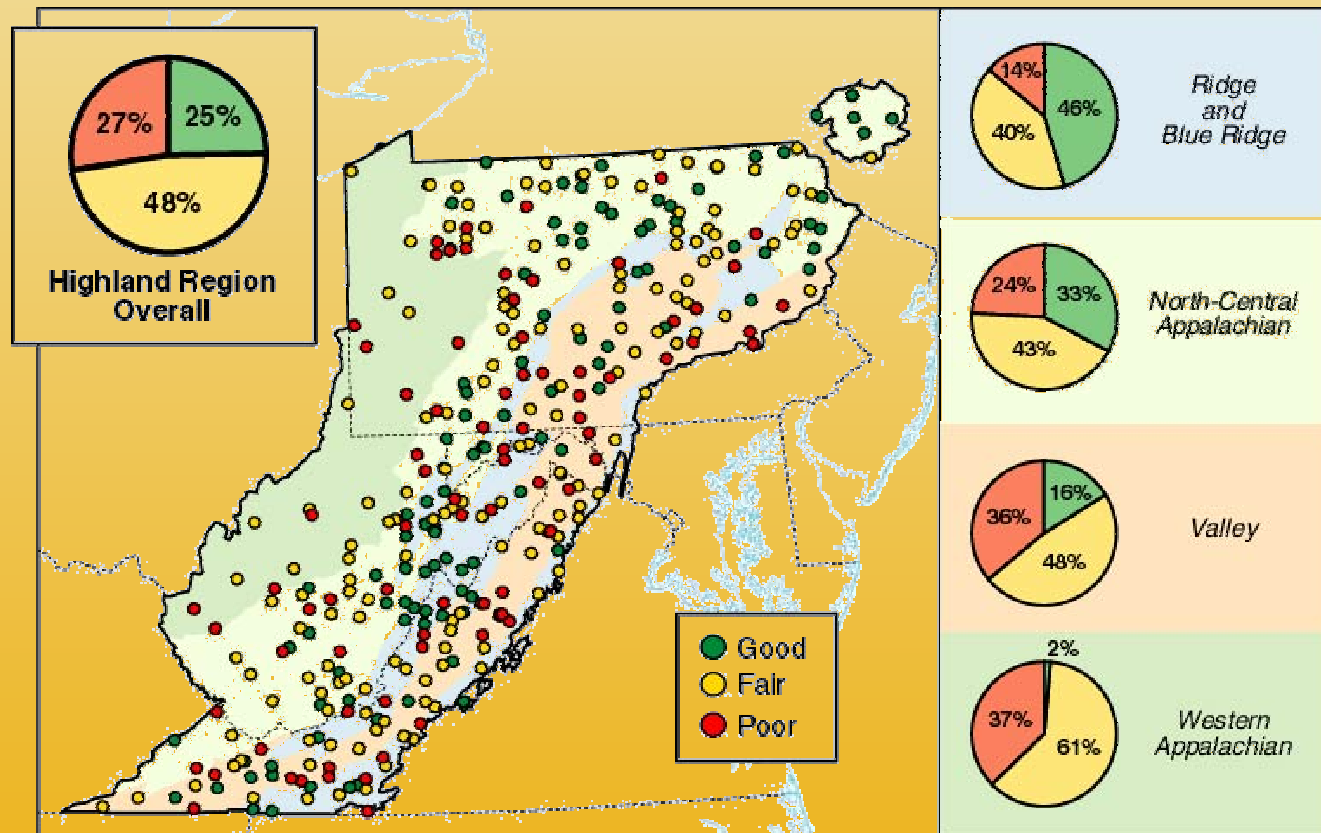
Descriptive Statistics
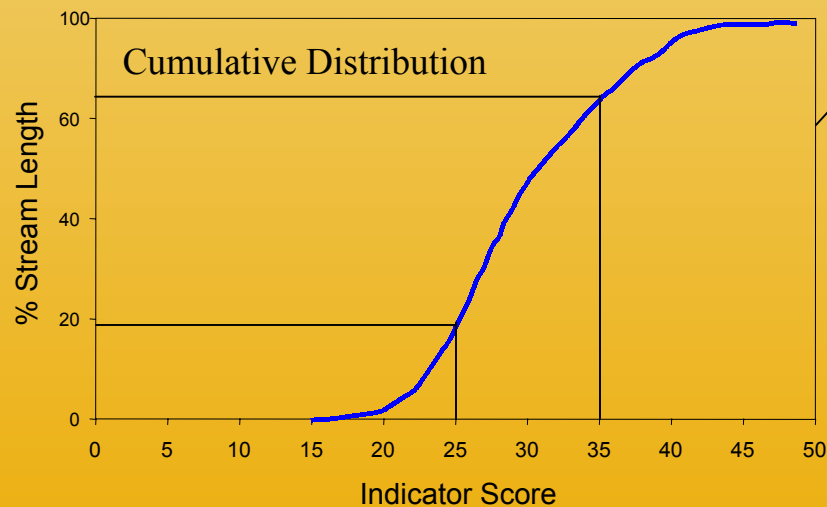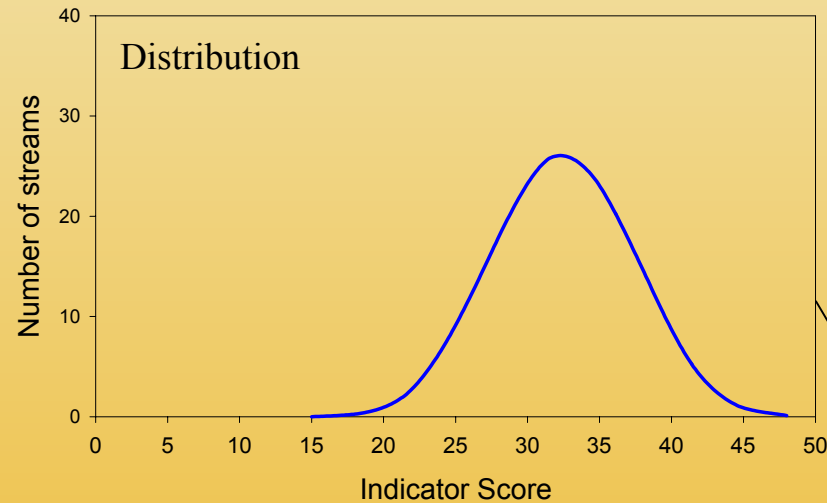
Interpreted Statistics

Example from Mid-Atlantic
Macroinvertebrate Results
Number of EPT Taxa

Physical Habitat Assessment Detail on Quantitative Measures

Thalweg Profile

- Measure maximum depth, classify habitat and pool-forming features, check presence of backwaters, side channels, and deposits of soft, small sediment at 10-15 equally spaced intervals between each of 11 cross-sections (100-150 total measurements)

- Measure wetted width and evaluate substrate size classes at 11 cross-section transects and midway between them (21 total width measurements and substrate cross-sections)

Woody Debris Tally

- Between each of the channel cross-sections, count large woody debris numbers within and above the bankfull channel according to length and diameter classes (10 separate tallies)

Channel & Riparian Characterization

- Measure
  - Cross section dimensions
  - Bank height
  - Undercut distance
  - Bank angle
  - Slope & compass bearing (backsight)
  - Riparian canopy density (densiometer)
- Observe & Record
  - Presence & proximity of human disturbances and large trees
  - Presence of alien plants

- Visually estimate
  - Substrate class size & embeddedness
  - Areal cover class & type (e.g., woody trees) of riparian vegetation in
    - Canopy
    - Mid-Layer
    - Ground Cover
  - Areal cover class of fish concealment features, aquatic macrophytes, and filamentous algae

Assessment of Channel Constraint, Debris Torrents, & Major Floods

- Identify features causing channel constraint
- Estimate the percentage of constrained channel margin for the entire reach
- Estimate the ratio of bankfull/valley width
- Check evidence of recent major floods & debris torrent scour or deposition

Discharge

- In medium & large streams measure water depth & velocity at 0.6 depth at 15-20 equally spaced intervals across one carefully chosen channel cross-section

- In small streams, measure discharge by timing the filling of a bucket or timing the passage of a neutral buoyant object through an estimated cross-sectional area

Water Chemistry

- *In situ*
  - Conductivity
  - Dissolved oxygen
  - Temperature
  - pH

- Grab Samples
  - Total N
  - Total P
  - Nitrate-Nitrite
  - Sulfate
  - Chloride
  - Ammonia
  - ANC
  - DOC

RBP Visual-based Assessment

- Seems like we should add a slide listing these too?